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Effect of the Free Core Resonance derived from tidal strain data

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To investigate the effect of the Free Core Resonance (FCR) we use the data from two European strain stations: Baksan (Russia), and Gran Sasso (Italy). Eight years of strain recorded by two crossed 90-m long laser interferometers (BA and BC) at Gran Sasso underground observatory, and six years of strain recorded by the 75-m long laser interferometer at Baksan underground observatory, have been analysed.

For the FCR parameter estimation we use 8 diurnal tidal constituents (namely Q1, O1, P1, K1, Ψ1, Φ1, J1, OO1) and compare measurements and model predictions through a joint fit on BAKSAN, BA, and BC tidal parameters minimizing the £[1] misfit function. As measurements we use the amplitudes of the sine and cosine terms of the observed tides, obtained from the output amplitudes and phases of the VAV03 code [Venedikov et al., 2003] applied on the pre-whitened strain series. Retrieved tidal parameters are corrected for ocean loading and local effects. Measured tidal parameters for the three interferometers in the diurnal band have been compared with predicted SNRE tides. The out-of-phase Φ1wave discrepancies are outside the uncertainties for all interferometers, and the Baksan out-of-phase J1wave discrepancy is outside the uncertainty too.

The results of analysis show that at the 80% (50%) confidence level the period of the Free Core Nutation (T_{FCN}) is between 413.5 (421.2) and 436.8 (431.0) sidereal days. The quality factor is badly constrained because of the large uncertainty on the Ψ1 phase. Probability density function of Q-factor shows a peak around 18000. The joint analysis confirms the results obtained from the analysis of the Gran Sasso strain tides only [Amoruso et al., 2012] and are comparable to those from gravity tides.

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